REMARKS

Withdrawal of the finality of the last Office Action and formal acceptance of the above amendments as a Submission in connection with U.S. PTO RCE practice is respectfully requested. Reconsideration and allowance of the above-identified application, as currently amended, is also respectfully requested.

By the above-made amendments, independent claims 4 and 14 were further amended to highlight the particularly characterizing aspects of the invention being covered. Specifically, the featured driving means of the operating fluid is now set forth as follows:

> (i) wherein said driving means of the operating fluid is made of electrically operated means for giving vibration to the hermetically enclosed operating fluid, and
>
> (ii) wherein the vibration giving means includes a resistor layer, positioned outside the closed flow passage of said operating fluid, which enables formation of bubbles in the operating fluid.

In accordance with the invention the driving means of the hermetically enclosed fluid, such as water, is made of electrically operated vibration giving means (to the operating fluid) including a resistor layer, positioned outside the closed flow passage of the operating fluid, which enables the formation of bubbles in the operating fluid. This is consistent with the showings of element 5 in the example embodiment(s) of Figs. 4 and 5(A)-5(B), Figs. 6 or 7 and also with regard to element 12 in Fig. 1 of the drawings, although not to be construed as being limited thereto.

The invention in independent claim 4 is a semiconductor integrated circuit chip, formed as a plate-like semiconductor chip, which comprises among the set forth aspects thereof, *a circuit forming layer...formed on one surface side of the plate-like semiconductor chip*, and *a heat transfer layer, connected with the plate-*

like semiconductor chip in one body, formed in an opposing surface side of the plate-like semiconductor chip. From Figs. 4 and 5(A) and Fig. 1, also, the heat transfer layer is formed on the surface side of the chip opposite the surface side thereof on which the circuit forming layer is formed and that the heat transfer layer is connected with the plate-like semiconductor chip in one body, consistent with that disclosed with regard to the above-noted example embodiments, although not to be construed as being limited thereto. Also, according to invention claim 4, the heat transfer layer comprises, in an inside thereof:

> a closed flow passage;
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> an operating fluid hermetically enclosed within said closed flow passage; and
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> driving means of said operating fluid,
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> wherein said driving means of the operating fluid is made of electrically operated means for giving vibration to the hermetically enclosed operating fluid,
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> wherein said heat transfer layer is made of a material similar to that of said semiconductor chip, and
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> wherein the vibration giving means includes a resistor layer, positioned outside the closed flow passage of said operating fluid, which enables formation of bubbles in the operating fluid.

Using the example embodiment shown in Figs. 4 and 5(A)-5(B) of the drawings, a localized rise in temperature in the electric circuit forming layer (e.g., 2) is suppressed by the heat transfer action of the hermetically enclosed fluid (e.g., operating fluid 4 which may be water) in the passage ducts (e.g., 3). The passage ducts are driven and/or operated substantially individually (or independently) by the "driving means" of the operating fluid, the driving means being made of electrically operated means for giving vibration to the hermetically enclosed operating fluid including a resistor layer (e.g., 5 and Figs. 4-7 or 12 in Fig. 1), positioned outside the closed flow passage of the operating fluid, which

enables formation of bubbles in the operating fluid. Discussion of the example embodiments shown in Figs. 4-5 is given from page 10, line 29, to page 13, line 9, and description regarding the transferring (diffusing) function of the heat generation in the integrated circuit, such as it relates to the example Figs. 1 and 5 embodiments is given beginning on page 15, line 26, of the Substitute Specification. As to the Example Fig. 1 illustration, unlike the structure shown in Figs. 5(A) and 5(B), the resistor films are formed on the lower surface side of the passage ducts 3 (e.g., see resistor layer 12).

Independent claim 14 similarly calls for a semiconductor integrated circuit chip featuring a heat transfer layer comprising a closed flow passage, an operating fluid hermetically enclosed within the closed flow passage and driving means of the fluid which is made of electrically operated means for giving vibration to the hermetically enclosed fluid, the vibration giving means including a resistor layer positioned outside the closed flow passage of the operating fluid and which enables formation of bubbles in the operating fluid.

The dependent claims specifically set forth various particularities of the invention, examples of which are featured in the illustrated embodiments, although not to be construed as being limited thereto. Specific discussions directed thereto are found in the Remarks of previously submitted Responses, which discussions are also incorporated herein for purposes of the present response. For example, the set forth aspect "temperature detecting means" is illustrated by reference numeral 7 with regard to Figs. 4-5 of the drawings. Also, the placing/positioning of the resistor layer or resistor layers at a region/regions where heat generation density is lower than the average density of the integrated chip as a whole is

featured in claim 5. It is submitted, the invention according to independent claim 4 and also according to the corresponding dependent claims 5-13 and 21 thereof, as well as that according to independent claim 14, are defining over the art, as applied in the outstanding rejections. Therefore, insofar as presently applicable, the rejections are traversed and withdrawal of the same is respectfully requested. The rejections will now be discussed.

I. Rejection of Claims 4-9, 11, 14 and 21 Under 35 U.S.C. §103(a), allegedly, as being obvious over Zuo (USP 6,631,077) in view of the published article Microchip Fabrication (by P. Van Zant)

The invention according to independent claim 4 or that according to independent claim 14 calls for integrating or building up a cooling system within the semiconductor integrated circuit chip so that it circulates the operating fluid within a closed flow passage such that localized hot spots, caused by the heat generation of circuits during operation thereof, are suppressed. According to the invention, a heat transfer layer is featured in the chip (or unitized with the chip) that comprises an electrically operated driving means (for giving vibration to the hermetically enclosed operating fluid) which includes a resistor layer which enables formation of bubbles in the operating fluid (see the "wherein" clauses of claim 4 and, likewise, of claim 14). According to the present invention, it is as a result of an electrically operated resistor layer and not as a result of mechanical vibration through which the fluid operates as a coolant to suppress elevation of heat. Since the present invention does not require mechanical or even electromechanical construction, malfunction concerns are also avoided.

Using the example illustration in Fig. 1 of the drawings, heat distribution is achieved by applying a pulse-like electric power to the resistor 12, giving rise to gas bubbles of the operating fluid. As a result of movement of the operating fluid

caused by the gas bubbling thereof, the heat generated on the electronic circuit layer side of the chip becomes transferred (or diffused), which leads to a more even distribution of the temperatures within the chip (see the discussion on page 16, line 9, to page 17, line 16, and also the further discussion on page 17, line 16, *et seq.* of the Substitute Specification). An even distribution is also enhanced with the additional presence of temperature sensors (e.g., see 7 in Figs. 5(A)-(B).)

Zuo discloses a PCB assembly (e.g., 100 in Fig. 1 and 700 in Fig. 7). Regarding the heat spreader 110 in Fig. 1 of Zuo, 130 effects an oscillating movement of the fluid 122 between opposing ends 112 and 113 of the base plate 111 by the channels 120. (Column 3, lines 15-30, in Zuo.) The oscillating means 130, which is integrally contained within the plate 111, is embedded in the fluid that flows in the channels 120 and operation thereof also involves mechanical movement. This is clearly in contradistinction with that defined in each of independent claims 4 and 14 and, correspondingly, according to the dependent claims thereof. That is, Zuo's teachings call for an oscillating means that not only is embedded within the fluid passageway and is mechanical, but is contained within the separately formed heat spreader and not as part of the chip 160 (e.g., see IC chip 160 and the separate heat spreader 110 in Figs. 3-5 in Zuo). Even the piezoelectric device such as 730 of Zuo, involves mechanical movement unlike the resistor according to the present invention which is an electrical element and is, also, located outside the passageway of the operating fluid (or coolant).

Notwithstanding the alleged teachings of Van Zant, regarding one chip microprocessors that contain both logic circuits and memory circuits, Van Zant,

applicants submit, does not overcome the deficiency of Zuo's teachings nor, for that matter, even if Zuo and Van Zant are considered in combination.

II. Rejection of Claims 10 and 13 Under 35 U.S.C. §103(a), allegedly, as being unpatentable over Zuo in view of Van Zant and O'Connor et al (USPG 2002/0039280).

The combination of Zuo and Von Zant are as that applied in the above rejection.

O'Connor was applied, allegedly, for its teaching of using "temperature detection means...." Notwithstanding O'Connor et al's alleged teachings, O'Connor also failed to disclose or suggest a cooling scheme with a chip as that presently set forth. Even if one of ordinary skill would have considered the combined teachings of the above-cited three references, the invention according to claims 10 and 13, both of which are based on claim 4, still could not have been achievable.

Therefore, in view of the above-made amendments together with these accompanying remarks, withdrawal of the finality of the last Office Action, as well as favorable action on the currently pending claims, i.e., claims 4-14 and 21, is respectfully requested.

Acceptance also of the request for temporary suspension for a period of up to three months, as noted in the RCE Transmittal form, is respectfully requested. In this regard the filing of a supplementing amendment is being considered.

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SUZUKI, et al.
520.43306X00

To the extent necessary, Applicants petition for an extension of time under 37 CFR §1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (Case No. 520.43306X00) and please credit any excess fees to such deposit account.

Respectfully submitted,

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Attachments
LNA:dlh/mlh